

industrial application of the science is represented by examples of machinery made by French firms, some descriptions of transmission plant and wireless telegraphy. This short account of the contents will show that the book covers, within its compass of some 430 small octavo pages, a wide field, and that for this reason alone anything like exhaustive treatment cannot be expected. Its usefulness is also marred by the defect very frequently found in Continental books of having no index.

In one respect the book is, however, an improvement on other French works on the same subject, and that is the use of mechanical illustrations of electrical phenomena. French men of science have always been adverse to graphic treatment or mechanical analogies. They are content to represent the subject in a purely analytical manner, and although it must be confessed that in elegance of mathematical treatment the French school is supreme, this kind of treatment does not lead so easily to an understanding of the subject as the use of graphic methods and mechanical analogies, which is a characteristic of the English school. Even so highly-trained a mathematician as Maxwell did not disdain the use of some very simple mechanical contrivance in order to make clear an intricate electrical phenomenon, and since Maxwell's time all English writers and most German have followed this lead.

Now we find that the author of the book under review has also gone over to the school of Faraday and Maxwell, and uses mechanical analogies to express electrical processes. As a good example of his methods may be taken the vectorial addition of currents illustrated by the apparatus of Prof. Gaillard, which was primarily designed to illustrate an alternating current of so slow a periodicity that it can be shown by the harmonic movement of a spot of light to a whole class of students (p. 185). Another model to represent three-phase currents and their properties is shown on p. 311. The mechanical representation of the principle of the inductor alternator, although, strictly speaking, not a model, but merely an incomplete machine, should prove useful to beginners.

The book is, in fact, written for beginners, if we may judge by the omission of many matters of more intricate nature. Thus, after explaining the process of commutation in a general way, the author dismisses the subject of sparking in a few lines by saying that in modern machines there is hardly any necessity to shift the brushes when the load changes. Nothing is said about commutation by brush resistance or interpoles, or Déri winding, or Parsons' compensating coils. Again, the short paragraph on inductive drop in a transformer is quite inadequate; we are told that the drop is from 1 to $1\frac{1}{2}$ per cent. in each coil, but not a word is said about the influence of the details of the design on the drop. In the matter of cooling a transformer the author is equally superficial; he merely says that 20 sq. cm. cooling surface per watt lost will produce an admissible temperature rise. Such general statements are perfectly valueless, and, in fact, worse than that, for they are untrue.

The author seems to have a great aversion to the use of mathematical formulæ even when they are very simple and convenient. He seems to start from the

supposition that his reader is so much of a beginner that he cannot even grasp the meaning of a very simple analytical expression, and to overcome this imaginary difficulty he uses numerical examples by preference. Most readers will consider this point of view to be wrong in principle. A man who is quite ignorant of even the simplest mathematics had better not attempt to study electrical matters, and if he has the modicum of mathematical knowledge required for the study of such elementary books as that under review, his task is not made easier, but more tedious, if matters that could be presented in three lines of mathematics are worked out in two pages of numerical examples. A striking instance of the clumsiness of this method is the deduction of the virtual value of an alternating current given on pp. 174 to 178. Here more than four pages of algebra and arithmetic are used to prove that the virtual current is equal to the crest value divided by the square root of 2. All this could have been shown by a few lines of very simple calculus, or, better still, by Blakesley's graphic method.

GISBERT KAPP.

A GERMAN TEXT-BOOK OF ZOOLOGY.
Lehrbuch der Zoologie für Studierende. By Dr. J. E. V. Boas. Fünfte vermehrte und verbesserte Auflage. Pp. x+668; 603 figs. (Jena: Gustav Fischer, 1908.) Price 12 marks.

THE fact that Prof. Boas's well-known text-book has now reached its fifth edition speaks volumes for the importance attached to the study of zoology in Germany. The book, although it contains 668 large and closely-printed pages, is an elementary one, and is designed especially, as we are told in the preface, for students of medicine, veterinary science, and forestry.

German ideas as to the preliminary education of medical students must be very different from those which are held by the medical profession in this country. Perhaps the German students work harder, or it may be that they cover a wider field in a more superficial manner. Dr. Boas's text-book makes us suspect that it is a little of both, and although we think that the subject might well receive more attention from English medical students than it now does, yet we should hardly care to place the present volume in their hands. Excellent and interesting as it is in many respects, it appears to us to suffer greatly from over-condensation, from the attempt to cover far too much ground. We miss the detailed anatomical description of types to which English students have become accustomed, and although this can easily be, and we fear frequently is, overdone, it can hardly be altogether dispensed with in an elementary text-book. It is true we find a short description of the Amœba by way of general introduction to the study of structure and function, but this is the only special type which is at all adequately dealt with. Probably it is intended that the detailed study of types should be undertaken in the laboratory with the aid of a special practical text-book, but we have not noticed any reference by the author to the importance of such practical work.

The book illustrates very clearly the great difficulties which attend the teaching of zoology at the present

day, and which are due, in the first place, to the enormous extent and variety of the animal kingdom, and in the second place to the many different points of view from which the subject may be approached. No elementary book can deal adequately with the entire field. In the present work, for example, the problem of heredity, which is of vital importance to medical students, is dealt with in a single page, while five pages are devoted to a general account of the Coleoptera. We should have thought that the medical student would have found the former altogether insufficient and the latter superfluous, and that a forestry student would require to know far more about beetles than can be compressed into five pages. Probably the latter studies entomology later on as a special subject, but if so it seems hardly necessary to attempt to deal with it systematically in his preliminary course.

We have already realised in our own country that systematic zoology, as such, is of very little use to medical students, and there can be no doubt that the insistence, in former years, upon an unnecessary degree of intimacy with the animal kingdom has done much to discredit the subject in the eyes of the medical profession, and has brought about a reaction which threatens to remove both zoology and botany from the medical curriculum. This, of course, would be a disastrous error. Medical studies must have a scientific foundation. The human body cannot be rationally interpreted except as the last link in a long chain of animal forms stretching back to the Protozoa. If the study of anatomy and embryology is to be inspiring it must be comparative. Scientific physiology must be founded on some knowledge of the lower animals, and the problems of heredity cannot be solved from the merely medical point of view. The zoology which is offered to medical students needs to be rigidly selected with such ends in view, and in this way only can the matter to be studied be kept within reasonable limits. In the book before us we cannot help feeling that the distinguished author has been unable to do justice either to himself or to his subject, but at the same time it is evident that his work has met with much appreciation in Germany. The numerous and excellent illustrations form a striking feature of the book. A. D.

SOME NEW CHEMICAL BOOKS.

- (1) *An Organic Chemistry for Schools and Technical Institutes.* By A. E. Dunstan. Pp. viii+160. (London: Methuen and Co., n.d.) Price 2s. 6d.
- (2) *An Intermediate Course of Laboratory Work in Chemistry.* By E. K. Hanson and J. W. Dodgson. Pp. viii+124. (London: Longmans, Green and Co., 1908.) Price 3s. 6d.
- (3) *Laboratory Notes on Industrial Water Analysis. A Survey Course for Engineers.* By Ellen H. Richards. Pp. iii+49. (New York: John Wiley and Sons; London: Chapman and Hall, Ltd., 1908.) Price 2s. net.

(1) M R. DUNSTAN'S organic chemistry is intended for the use of the higher forms of schools and as a first-year course in technical institutions.

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Although the author disclaims writing to a syllabus, he thinks his book may be useful as a preparation for certain examinations, and especially for evening students connected with chemical industry. There are so many elementary text-books of organic chemistry at present available that one naturally looks for some special feature which may distinguish one from another. In the present case the fusion of the aliphatic and aromatic series is a somewhat new departure. As systems of classification of organic compounds are mainly matters of convenience, it is questionable whether any real advantage is offered by the new arrangement. The parent hydrocarbons of the two series, as well as the majority of their derivatives, present such marked differences in properties that their separation seems to us almost a natural one. The new system has, however, no serious significance, and does not detract from the sound merits of the book, which is clearly written, and illustrated by numerous experiments and plain outline drawings of apparatus.

We would direct the author's attention to a few inaccuracies. The definition of organic chemistry as "the chemistry of compound radicals" (p. 17) belongs rather to the past than to the present; it is not quite correct to say that Russian petroleum contains no paraffins (p. 79); the explanation of specific rotation is misleading (p. 98); the formula for copper acetylide is incorrect (p. 109), and there is something wrong about the two formulæ for sodium ethyl malonate numbered (1) and (2) on p. 117, which seem to be identical. The two space formulæ for *d*- and *l*-tartaric acids are not enantiomorphous but identical, and represent the *meso*-form, whilst the one on the following page, which is intended for the *meso*-acid, is in reality one of the active forms (p. 124). The differences are most easily recognised by means of models. Acetoxime is twice spelt wrongly on p. 148.

(2) Messrs. Hanson and Dodgson's intermediate course is intended for students preparing for the intermediate science examination of the London University. It consists of series of simple preparations of inorganic and organic compounds, which are followed by exercises in volumetric and gravimetric analysis and qualitative analysis. There is little that calls for criticism. The preparations are well selected, and cover a variety of operations and reactions, and the analytical exercises are thoroughly representative and instructive.

If it were not "assumed throughout that the student is not working by himself, but can obtain the advice and assistance of a teacher at all times," one might feel disposed to suggest the addition of equations to explain the different preparations, and of some reference to the use of the balance and the graduation of the volumetric apparatus.

We would also suggest that the yield in each preparation should be roughly estimated.

It is scarcely correct to describe acetone as a pale yellow liquid (p. 29), or the acid from olive oil as a solid (p. 30).

Photography applied to glass apparatus is rarely satisfactory. Simple outline or shaded drawings are much more convincing, and the teacher, it is to be